

## ABSTRACT OF DISCLOSURE

Methods are disclosed for producing architectural preforms and high-temperature composite structures containing high-strength ceramic fibers with reduced preforming stresses within each fiber, with an in-situ grown coating on each fiber surface, with reduced boron within the bulk of each fiber, and with improved tensile creep and rupture resistance properties for each fiber. The methods include the steps of preparing an original sample of a preform formed from a pre-selected high-strength silicon carbide ceramic fiber type, placing the original sample in a processing furnace under a pre-selected preforming stress state and thermally treating the sample in the processing furnace at a pre-selected processing temperature and hold time in a processing gas having a pre-selected composition, pressure, and flow rate. For the high-temperature composite structures, the method includes additional steps of depositing a thin interphase coating on the surface of each fiber and forming a ceramic or carbon-based matrix within the sample.